# Report for 2005OR69B: Groundwater and Surface Water Resources in the Williams Creek Watershed, Southern Oregon

Publications

- There are no reported publications resulting from this project.

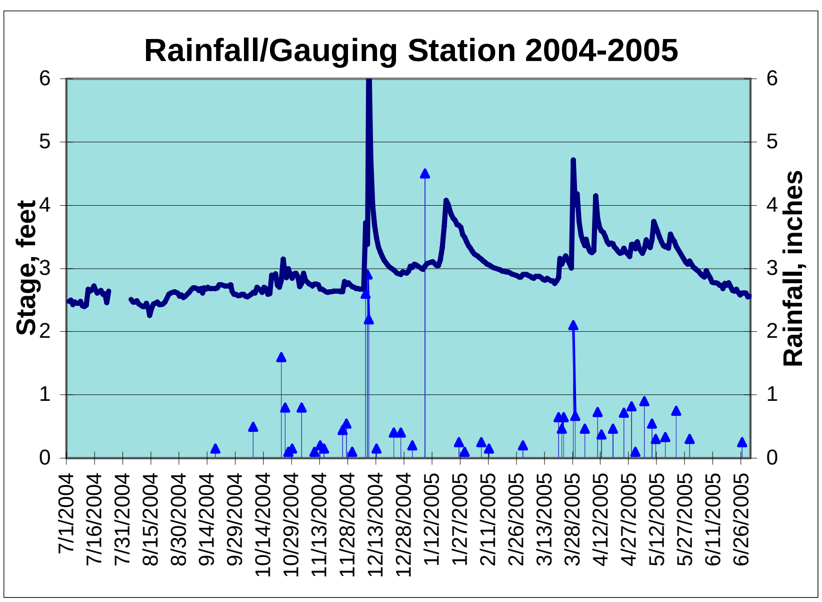
Report Follows

**Groundwater Studies within the Williams Creek Watershed**
**by Charles Rogers**

The recently completed *Williams Creek Watershed Groundwater Assessment* encompasses the need to understand the connection of groundwater to surface water and develop an understanding of the local hydrologic cycle and to use this knowledge in formulating policy and procedures in future management. Irrigation withdrawals and domestic well development in the Williams Valley affects streamflow along with the instream needs of aquatic wildlife. The information is vital in developing strategies that improve watershed health, provide for minimum instream flow, supply irrigation needs, consider domestic water needs, and in seeking methods to improve groundwater availability.

The purpose of this groundwater study is to collect information about the groundwater in the Williams Creek Watershed and investigate the potential for increasing efficiency of irrigation through the wise use of groundwater. Use of groundwater could alleviate some of the problems of withdrawal of surface water, but its overuse could also deplete the resources so other problems would be encountered. Our goals are to develop an understanding of the groundwater to promote wise and judicial use over time in order to maintain the resources without overuse and depletion. Overuse could result in output reduction in private wells and having to seek other sources for domestic use. Our objectives are to develop a plan to utilize groundwater resources without adversely affecting the amounts of water in the stream system for maintaining salmon and other aquatic species habitat.

The main conclusion drawn from this study is that groundwater is the main source of water for streamflow, especially during long summer dry spells. Winter rains produce high flows in streams but a steady base flow results from the discharge of groundwater. Steep terrain and rapid surface water outflow produces flashy surface systems as evidenced by detailed data collection by our new gauging station on lower Williams Creek. Groundwater originates from precipitation in the upland recharge regions, which are highly forested, and moves downslope to the lower topographic areas where most people live and wells are developed. This groundwater supply is highly dependent on annual precipitation.

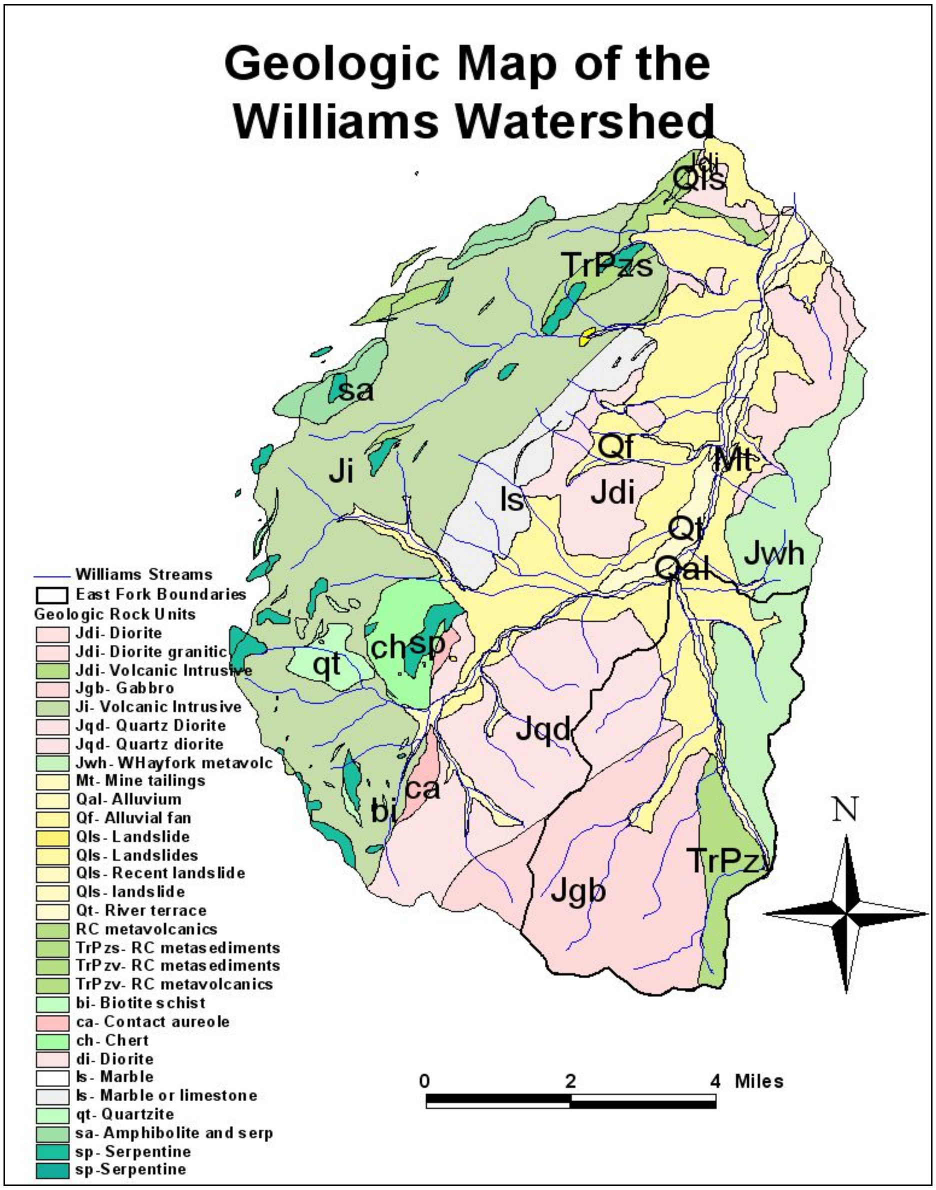



**Williams Creek Gauging Station Recordings for 2004-2005**

This graph shows the stage or height of the creek as a solid line with corresponding rainfall amounts shown as arrows rising from the bottom (collected in the upper watershed of the East Fork).

The general geology was mapped by Oregon state registered geologist, Robert Murray in 2002 and compiled for this study and reflects the latest known information available in this area.

The geology of the Williams Creek Watershed is composed of Klamath Mountain accreted terranes made up of volcanically derived sediments, volcanic island arcs, and granitic plutonic rocks. The eastern part of the watershed is composed of metavolcanic sediments and quartzites of the Applegate Group. Plutonic rocks of gabbro, quartz diorite, and diorite form a central north-south trending zone of multi-phase granitics that include the highlands of Grayback Mountain as well as the deeply eroded central part of the valley floor. The western ridges are composed of basalt, ultramafics, volcanic sediments, and marble lenses that are a part of mélange of accreted volcanic archipelagos of the Pacific tectonic plate. These terranes are separated by old subduction faults containing mylonites and other metamorphic rocks.



Our assessment considering the geology and well yields within the Williams Creek watershed is as follows:

1) Alluvium is the major aquifer in the Williams Creek Watershed. Where 10 feet or more of alluvium occurs below the water table, most wells obtain their water from the alluvial deposits. Well yields vary considerably and range from less than 10 gpm to 30 gpm or more in some areas with some wells reporting yields of 60 gpm or more.

2) Alluvial fans, like that found in the Powell Creek drainage produce large yields. Buried conglomerate, gravel, and other rocks produce good hydraulic conductivity. Other areas with landslide deposits that drain mountainous areas report large yields in wells.

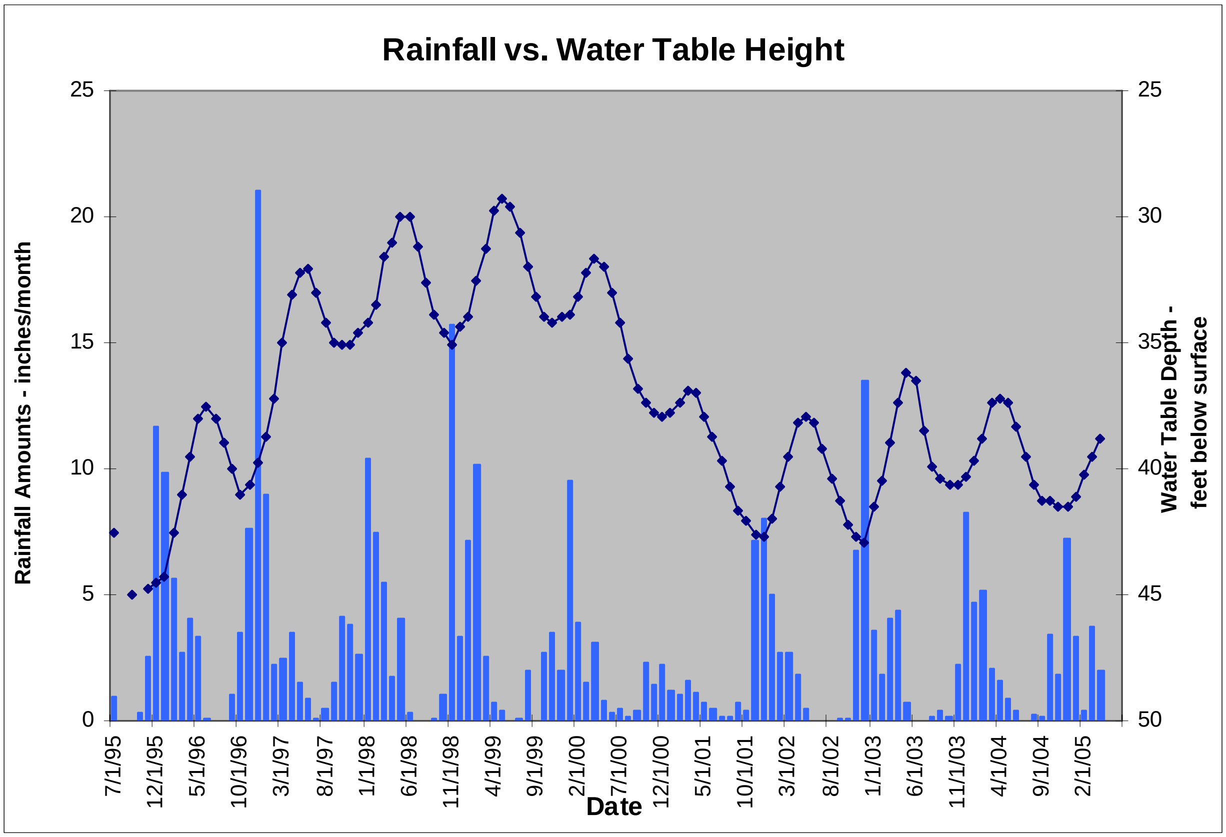
3) Granitic intrusive rocks of the Grayback Mountain Pluton serve as aquifers in areas where these rocks are found. Well yields depend largely on the depth and degree of weathering and the extent of fracturing of the rocks, which varies considerably throughout the watershed. Well yields range from 3 gpm in solid bedrock to areas with 60 gpm or more where weathered or fractured zones are encountered during drilling.

4) Well yields are generally small in the ultramafic and mafic rocks of the western ridges of the Williams Creek Watershed. The western ridge contains rocks of the Rattlesnake Creek Terrane composed of a mélange of volcanic, ultramafic, mafic, serpentine, quartzite, and marble. Few wells are drilled in this area but those reported show less than 10 gpm. Water quality is generally lower in these areas with one well showing presence of dissolved metals in water analysis.

5) The granitic alluvium shows the highest yields and contains the bulk of water resources in the Williams Valley. The depth to the bedrock is important in completion of wells as most water is encountered at the alluvial bedrock interface where groundwater is perched above granitic bedrock. Weathered granitic rocks can hold and transfer large amounts of groundwater and are found at the upper levels of the granitic basement below alluvial deposits. Fractured granitic rock is a good carrier of groundwater and is reported in the upper levels of the granitic bedrock. It is unknown where or how deeply fractured granitic rock occurs but wells drilled into these rocks can produce water yields in the 30 to 60+ gpm range. Water quality in these areas is good.

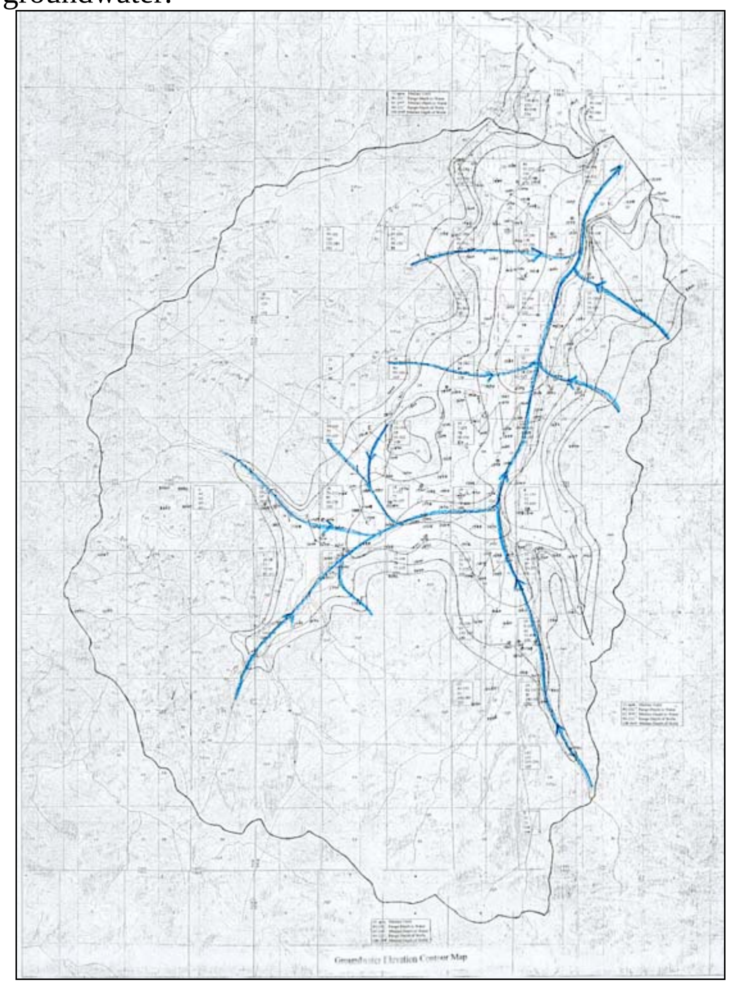
6) The eastern ridge of the Williams Creek Watershed contains metavolcanic rocks of the Applegate Group. Well yields in these areas vary considerably but yields are low unless fractured or concentrated by topographic features but are generally high enough for domestic use. Depths to water and total depth of well required may be greater in the steeper areas. Water quality is good but variable.

Groundwater movement is slow and lags behind general rainfall patterns. These lags produce higher water tables during early summer months and lower water tables during fall months with the lowest water table measurements occurring in December. The lag is highly variable from well to well, but is as much as 3 to 4 months in some areas. Groundwater fluctuations in monitored wells indicate that some wells have small vertical change in the water table over time while others have larger fluctuations. Groundwater levels fluctuate seasonally between 5 to 20 feet as measured in six wells. Any well use draws water from the groundwater supply and reduces the discharge into streams. If annual precipitation produces sufficient water for recharge, there will be little effect seen. If drought occurs, problems could arise in wells and irrigation systems throughout the valley, especially in the late summer months. Some wells will be fine for one or more years of drought. Others, particularly ones with low yields, will be the ones that will feel the drought effects.



The presence and distribution of groundwater in the watershed is perhaps the most important aspect in making the Williams Valley a livable and productive environment. If we had to select a geologic aspect that shapes and controls the lives of residents and wildlife alike, it would be the movement of groundwater. Groundwater movement is controlled predominately by the nature of rocks that underlie the surface, the topography of the basin, and geologic controls and boundary conditions. Groundwater generally moves slowly down gradient under the influence of gravity through rock and soils at differing rates depending on the physical characteristics of the unconsolidated and consolidated earth materials.

Higher elevation regions around the basin are the forested lands that constitute a major recharge zone of the Williams Creek Watershed. Infiltration rates vary considerably on differing topsoil and subsoil types, but vegetated soils and forested areas retain water onsite longer. Soil and vegetation slows runoff, which, if the permeability is present, will assist in infiltration of rain and snowmelt. Recharge zones are important components of groundwater systems because they are the major source of groundwater.



Surface water systems observable by numerous springs, ponds that are spring or groundwater fed, and perennial streams throughout the basin are dependant on groundwater to supply them with year-round water, especially during the summer months. Groundwater discharge is the major source for surface flow systems in this area.

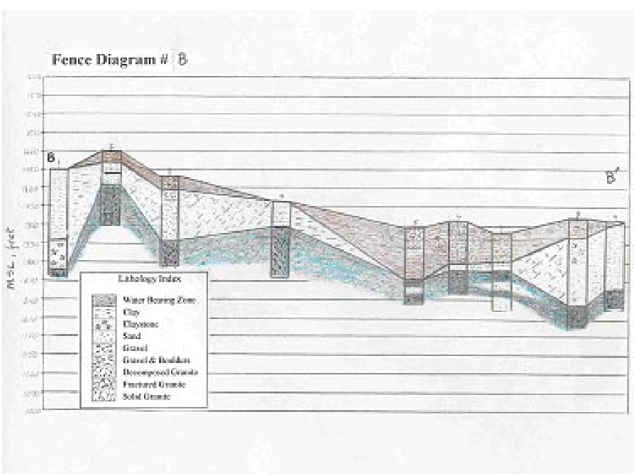
Alluvial Cross Sections and Fence Diagrams

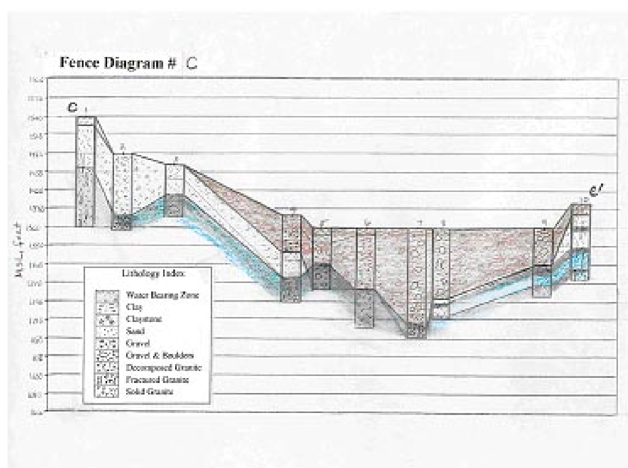
Fence diagrams are constructed from existing well log data and use the drillers report to analyze and develop an understanding of the water levels encountered along with the subsurface geology. Each log was studied for specific layers of rock that carry or resist groundwater storage and movement. Particularly important are the alluvial deposits that most wells are drilled into, including unconsolidated sands and gravels, weathered bedrock, fractured and solid bedrock.

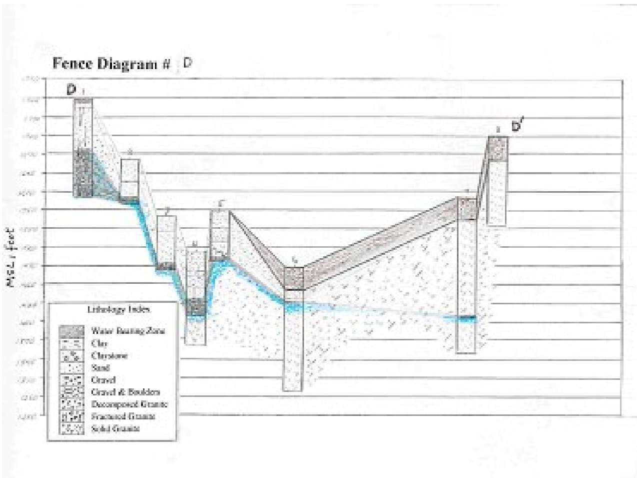
These fence diagrams show shaded areas that represent the alluvium at the top including soil, clay, sand, and boulders. They correspond to the cross sections on the well summary maps at the back of this report. The lower shaded area represents the reporting of water encountered at each well, connected by fence diagrams. The middle clearer area represents the granitic basement. Fence diagrams were located where wells were abundant, data was relatively reliable, and questions about groundwater are important.

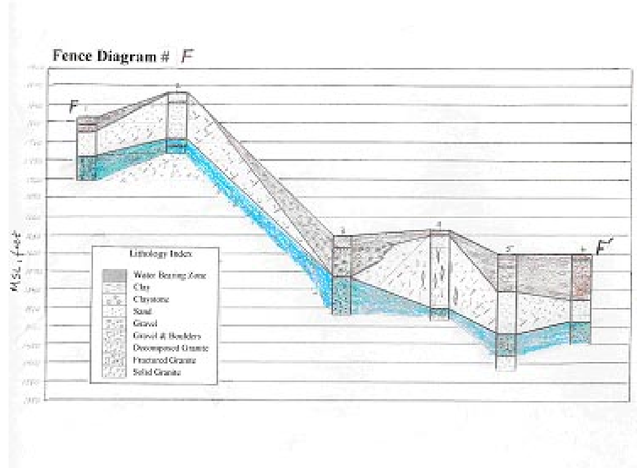
Fence diagrams have been simplified to show characteristics that are important to this study and can only be used as a guide to understanding the subsurface. The lithology Index included with the cross sections can be used as a guide to the rock type reported by drillers in well logs. Fence diagrams use the well logs as a guide to tie the regions between the wells to help understand the general patterns of subsurface deposits and their connection to groundwater occurrence.

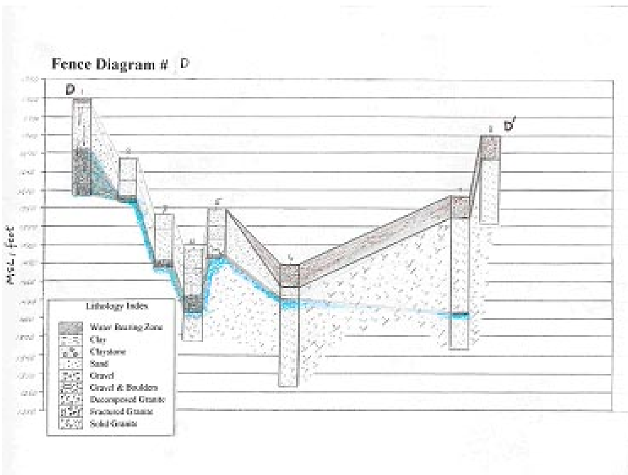
Well logs were interpreted by students at Southern Oregon University under a minigrant provided by the CWESt and the USGS. These diagrams have a vertical exaggeration of approximately 5 times the horizontal.






The final *Williams Creek Watershed Groundwater Assessment* is a 100-page report that contains all the findings and data collected. This study was funded in large part by the Oregon Watershed Enhancement Board, dedicated to improving watershed health and function with the goal of improving salmon habitat through good science and dedication of local communities. Supplemental funding was provided by:

- The Conservation and Research Foundation
- Mountaineers Foundation
- United States Geological Survey (USGS) and the Center for Water and Environmental Sustainability (CWest) from Oregon State University

Technical support was obtained from Ivan Gall, hydrogeologist for the Oregon Water Resources Department, Tom Wiley, state geologist of the Oregon Department of Geology and Mineral Industries, and geologic mapping by Robert Murray, Oregon State Registered Geologist. Local landowner, Lee Miles provided detailed science and data collection. Many other landowners provided access to monitor their wells. Finally, the Williams Creek Watershed Council Board helped establish and build the gauging station on Williams Creek. Thanks to all who helped make this report possible.